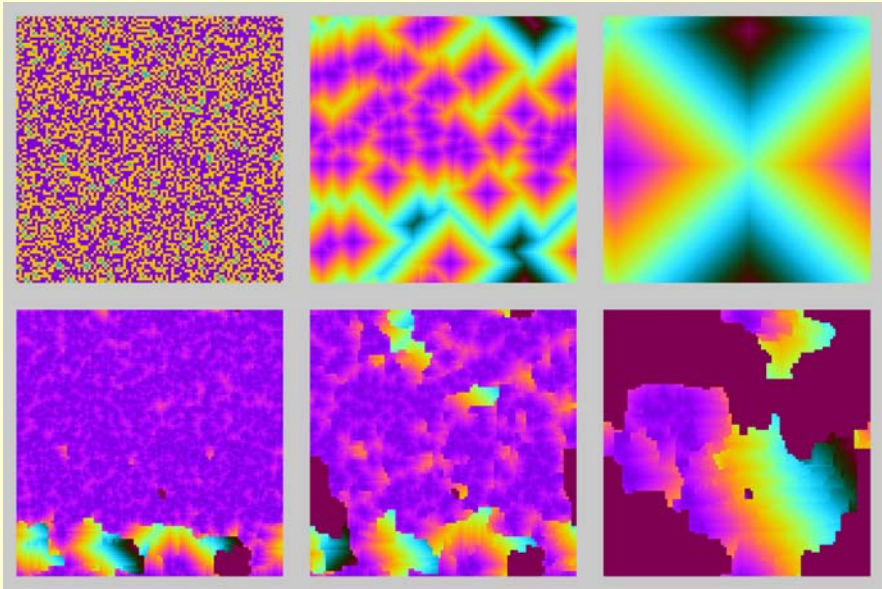
Phases and Dynamics of Disordered Condensed Matter Systems

A. Alan Middleton, Syracuse University, DMR-0109164, 9702242

- In this project, we use computers to study the nature of materials that are not perfect crystals, including their static behavior, electrical conduction, and their plastic flow under external stress.
- Part of this work has illuminated a strong connection between algorithms adopted from the computer science community and disordered materials.
- The results include the fractal properties of the phases. The novel demonstration of uniqueness of the optimal solution shows that optimization algorithms can be significantly improved for, say, magnets with disorder.

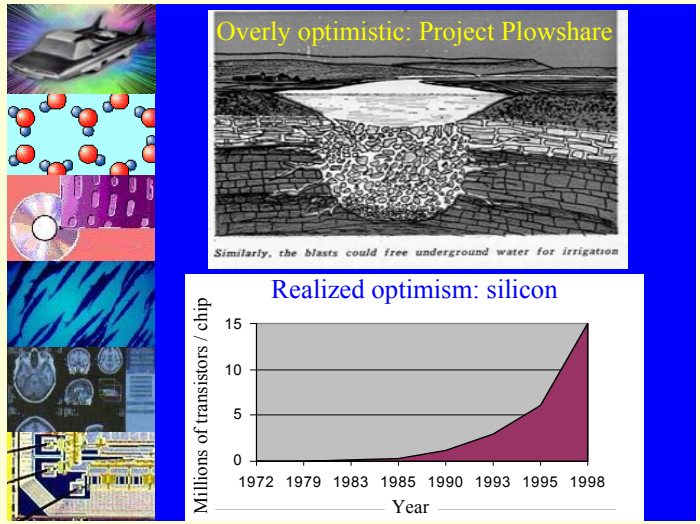


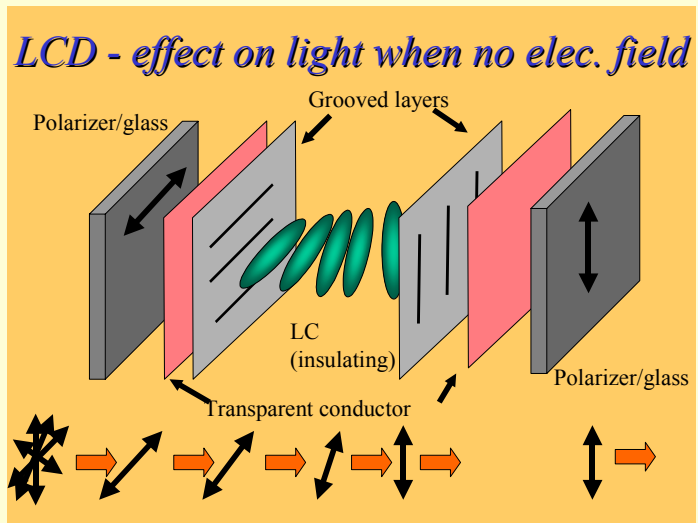
Each row visualizes the application of an optimization procedure to finding the lowest energy state of a magnet. Computation time runs from left to right. Colors show the values of auxiliary variables used while finding the optimal solution. The evolution of these patterns has been related to ideas from phase transitions.

Phases and Dynamics of Disordered Condensed Matter Systems

A. Alan Middleton, Syracuse University, DMR-0109164, 9702242

- The CAREER portion of the grants supported the development of "Science for the 21st Century", a liberal arts course. This course focuses on nontraditional physics material, especially the science needed to understand the hardware of current technology. The students learn how liquid crystal displays work, using ideas about light and matter and their own lab experiments.
- These grants have also helped support training through research -
  - *3 undergraduates:* Chuck Fidler, Hollie Laudal, Yiu Tse
  - *3 graduate students:* David McNamara, Shantenu Jha, Bety Rodriguez
  - *4 postdocs:* Chen Zeng, Thomas Prellberg, Jennifer Schwartz, Karl Saunders





Sample slides from "Sci. for the 21st Century"